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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/809,074	03/16/2001	Shinya Nagamatsu	204842US-8	5550

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OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER

LEUNG, QUYEN PHAN

ART UNIT PAPER NUMBER

2828

DATE MAILED: 02/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/809,074

Applicant(s)

NAGAMATSU ET AL.

Examiner

Quyen P. Leung

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 December 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-9,12,14-19 and 21-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 5,9-11,14-19 and 21-23 is/are allowed.
- 6) ☒ Claim(s) 1,3,4,6-8 and 12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

1. In response to applicant's amendment filed 12/1/2003, claims 1, 3, 7, 9, 12, 14, 23 have been amended. Claims 1, 3-9, 12, 14-19, 21-23 are pending.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 3-4, 6-7, 8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 3 recites in the first paragraph "at least one laser diode module" and in the last paragraph "a plurality of laser diode modules". It is unclear how these are related. Claims 4,6-8 are rejected for the same reason.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1 and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Miyake et al (4,791,634). Miyake et al discloses a light source (30) comprising a plurality of densely placed laser diode modules (36) mounted on a mounting portion (38), each of the modules (36) having an output of at least 100 mW (see math below),

and a plurality of heat pipes (50) thermally connected to the mounting portion (38), the plurality of heat pipes (50) having a heat absorbing portion (82) and a heat radiating portion with heat radiating fins (86).

FIG.2A

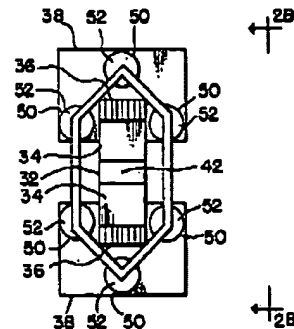


FIG.2B

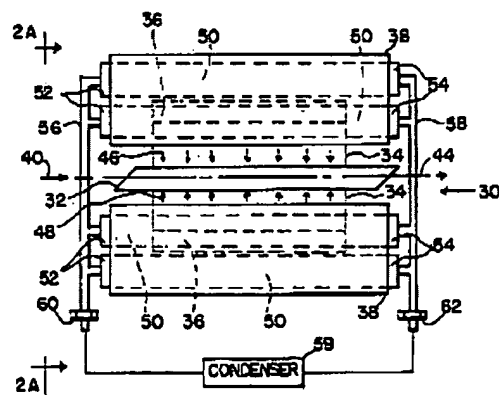
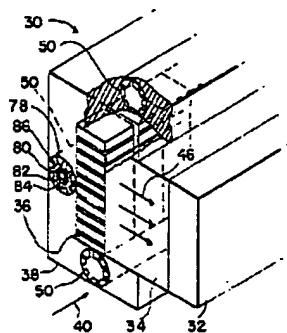


FIG.3



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4,791,634

5 made from Nd:YAG, which has a particularly high absorbance of light at an 810 nanometer wavelength. The diode array 36 can be supplied with pulsed DC power having an amplitude of 200 volts and a pulse length of 200 nanoseconds. In one embodiment, the diode array 36 produces an approximate average of 8 watts per square centimeter. Since the diode array is approximately 25% efficient, it will transfer approximately 2 watts per square centimeter of light into the block 34 and approximately 6 watts per square centimeter of heat into the conductive substrate 38. The semiconductor material slab 32 converts the light energy it receives from the diode array 36 to light at the output wavelength with an efficiency of approximately 28%. The overall conversion efficiency of the DPSL is, accordingly, $0.25 \times 0.28 = 0.07$, or 7%.

The input beam received by the semiconductor material slab 32 in the direction indicated by the arrow 40 can have a wavelength of 1060 nanometers. Therefore, the amplified output beam produced in the direction of the arrow 44 (see FIG. 2B) is a series of 200 nanosecond pulses of 1060 nanometer light whose energy gain is 7% of the electrical energy input to the diode array 36.

The diode array 36 is a layered structure of longitudinally extending thin diode strips 102. It is particularly advantageous to interleave the diode strips 102 with heat sink strips 104 made, for example, from copper. The layered structure of thin strips is oriented parallel to the axis 42. The pump light (for example, at 810 nanometers) passes through the liquid channel 107 into the semiconductor material slab 32 at about ninety degrees to the axis. The diode array 36 is positioned immediately adjacent the liquid channel 107.

6 condenser (not shown) to be recondensed into the liquid phase.

The diode strips 102 and the heat sink strips 104 are each approximately 0.5 millimeters thick. The diode strips 102 are approximately 5 millimeters wide. If heat sink strips are approximately 10 millimeters wide. If the vertical dimension of the DPSL 30 shown in FIG. 4 is 9 centimeters (as shown by arrow 103), the diode array can consist of approximately ninety diode strips 102 alternating with ninety heat sink strips 104. The length of the DPSL 30 in the direction of the axis 42 can be chosen to produce the output power desired. If the DPSL 30 is approximately 12 centimeters long, and the pulse frequency is ten pulses per second, the energy per pulse is approximately one to two Joules per pulse.

Referring to the graph of FIG. 3, which shows two curves parameterized by the heat flux capability of the cooling system, Q_{max} , and assuming that the solid state material slab 32 is a 12 centimeter long by 2 centimeter wide Nd:YAG slab, the operating region for a DPSL is shown below each of the curves given.

Those skilled in the art of diode slab laser design will appreciate that various modifications of the foregoing

As evidenced in the above excerpts, it is inherent that each laser module produces at least 100 mW of output, because Miyake teaches that:

- (1) the laser modules (36) produce output of about 8 Watts/cm²,
- (2) the laser modules (36) comprise thin diode strips (102) interleaved with heat sink strips (104),
- (3) each thin diode strip has a dimension of 0.5 mm x 5 mm, or equivalently 2.5 mm² or 0.025 cm², and
- (4) each heat sink strip has a dimension of being 0.5 mm x 10 mm, or equivalently 5 mm² or 0.05 cm².

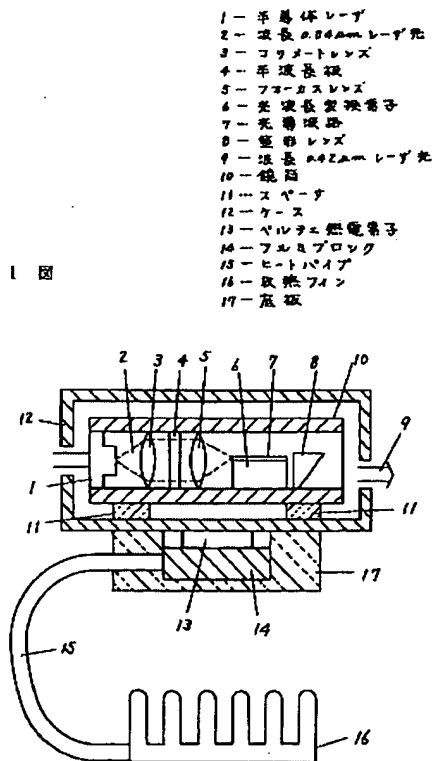
Considering each module to be one thin diode strip and an adjacent heat sink strip, the approximate area per module is therefore about 0.075 cm². Multiplying the

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output per area (i.e. 8 Watts/ cm²) and the area per module (i.e. 0.075 cm²) results in 0.600 Watts/module, or equivalently 600mW/module.

6. Claims 3, 7 are rejected under 35 U.S.C. 102(b) as being anticipated by Omori et al (JP 04-179180). Omori discloses the claimed invention. Omori teaches a light source comprising at least one laser diode module comprising a metal substrate (14), a laser diode chip (1), an optical component (3), a peltier (13), a heat pipe (15) comprising a heat absorbing portion (near the metal substrate (14)) and a heat radiating portion with radiating fins (16).

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Response to Arguments

7. Applicant's arguments with respect to claims 1 and 12 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Quyen P. Leung whose telephone number is (571)272-1943. The examiner can normally be reached on 9-5:30, M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Ip can be reached on (571)272-1941. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Quyen P. Leung
Primary Examiner
Art Unit 2828

QPL